

1 The opinion in support of the decision being entered today was *not* written
2 for publication and is *not* binding precedent of the Board.

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5 UNITED STATES PATENT AND TRADEMARK OFFICE
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8 BEFORE THE BOARD OF PATENT APPEALS
9 AND INTERFERENCES
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12 *Ex parte* YOUICHI AKASAKA
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15 Appeal 2007-0680
16 Application 10/655,901
17 Technology Center 3600
18

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20 Decided: March 29, 2007
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23 Before ROBERT E. NAPPI, LINDA E. HORNER, and ANTON W.
24 FETTING *Administrative Patent Judges*.

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26 NAPPI, *Administrative Patent Judge*.
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29 DECISION ON APPEAL
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31 This is a decision on appeal under 35 U.S.C. § 6(b) of the final
32 rejection of claims 1, 4 through 11 and 14 through 20. For the reasons stated
33 *infra* we will not sustain the Examiner's rejection of these claims.
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INVENTION

The invention is directed to an amplifier for an optical communication system. A light beam used to provide pumping power is split, a portion is coupled to a fiber in the direction counter to the direction of the signal propagation. The other portion is coupled to a second fiber in the direction of signal propagation in that fiber. See page 3 of Appellant's specification. Claim 1 representative of the invention and reproduced below:

1. A communication system for distributed Raman amplification of optical signals, the communication system comprising:
a first fiber span;
a second fiber span;
a third fiber span;
a first pump system configured to generate and transmit a first light beam;
a first splitter configured to receive the first light beam, split the first light beam into a first portion of the first light beam and a second portion of the first light beam, transfer the first portion of the first light beam onto the first fiber span to backward propagate over the first fiber span, and transfer the second portion of the first light beam onto the second fiber span to forward propagate over the second fiber span;
a second pump system configured to generate and transmit a second light beam; and
a second splitter configured to receive the second light beam, split the second light beam into a first portion of the second light beam and a second portion of the second light beam, transfer the first portion of the second light beam onto the second fiber span to backward propagate over the second fiber span, and transfer the second portion of the second light beam onto the third fiber span to forward propagate over the third fiber span;
wherein a power of the first portion of the first light beam is not equal to a power of the second portion of the first light beam; and

1 wherein a power of the first portion of the second light beam is not
2 equal to a power of the second portion of the second light beam.

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4 REFERENCES

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6 The references relied upon by the Examiner are:

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8 Grubb US 6,344,922 B1 Feb. 5, 2002

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10 Fidric US 6,603,593 B2 Aug. 5, 2003

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12 C.R.S. Fludger et al. (Fludger), "Pump to Signal RIN transfer in
13 Raman Fibre Amplifiers" Electronics Letters, Vol. 37, No. 1, Jan. 4, 2001 pp
14 15-17.

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16 Govind P. Agrawal, Fiber-Optic Communication Systems, 3rd Edition,
17 Wiley Interscience, May 28, 2002, pp. 243-246.

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20 REJECTION AT ISSUE

21 Claims 1, 4, 11, and 14 stand rejected under 35 U.S.C. § 103 (a) as
22 being unpatentable over Grubb in view of Fludger. The Examiner's rejection
23 is set forth on pages 3 and 4 of the Answer. Claims 5, 6, 8, 15, 16, and 18
24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Grubb in
25 view of Fludger and Fidric. The Examiner's rejection is set forth on pages 4
26 and 5 of the Answer. Claims 7, 9, 10, 17, 19, and 20 stand rejected under 35
27 U.S.C. § 103(a) as being unpatentable over Grubb in view of Fludger and
28 Agrawal. The Examiner's rejection is set forth on pages 5 and 6 of the
29 Answer. Throughout the opinion we make reference to the Brief and Reply

1 Brief and Reply Brief (received May 2, 2006 and July 28, 2006 respectively),
2 and the Answer (mailed June 26, 2006) for the respective details thereof.

4 ISSUES

5 Appellant contends that the Examiner's rejection of independent
6 claims 1 and 11 under 35 U.S.C. § 103(a) is in error. Appellant argues that
7 Fludger does not discuss the effects on RIN¹ in a fiber that is both forward
8 and reversed pumped with unequal power. Further, Appellant argues that
9 because Fludger teaches that counter-pumping is favored over co-pumping,
10 Fludger teaches away from combined forward and reverse pumping
11 implemented simultaneously over a single length of fiber, as taught by Grubb
12 (Br. 7-9).

13 The Examiner asserts that the rejection is proper. The Examiner states,
14 on page 7 of the Answer, that simultaneous forward and backward pumping
15 and an uneven split of a single light beam are not limitations recited in the
16 independent claims. Further, the Examiner asserts that Fludger is directed to
17 performance over a transmission system.

18 Appellant rebuts the Examiner's claim interpretation in the Reply
19 Brief, asserting the independent claims 1 and 11 recite simultaneously
20 forward and reverse pumping a fiber strand and an uneven split of a single
21 light beam (Reply Br. 3-4).

22 Thus, the issues before us are whether the independent claims recite
23 simultaneously forward and reverse (co-pumping and counter-pumping) a

¹ "RIN" stands for relative intensity noise (Fludger 16, left column).

1 fiber strand, and an uneven split of a single light beam. The further issue is
2 whether the combination of the references teaches these limitations.

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4 FINDINGS OF FACT

5 Grubb teaches many arrangements for optical communication systems.
6 Grubb teaches that optical pump energy can be supplied to an optical fiber
7 counter, and/or co-directionally to signal propagation (Grubb, col. 9, ll. 10-
8 26). Grubb teaches an arrangement in figure 5(a) where there are several
9 fiber segments 28, 30 and 40 and there are several pumping sources (lasers
10 items 32 and couplers 36). Figure 5(a) depicts the pumping energy going
11 through a distributor (item 24) and being coupled in manner that appears to
12 forward and reverse pump the fibers (note, signal propagation is left-to-right,
13 the splitters appear to provide pumping power to fibers to the left (counter
14 pumping) and the right (co-pumping)). However, the description of figure
15 5(a) states that the pump source provides power “counter-directionally to the
16 optical signals being transmitted.” (Grubb, col. 9, ll. 28-33). Further, we
17 note that Grubb states that distributor 24 is “known in the art” and provides
18 no explanation of whether it produces an even split of the signal or an
19 uneven split of the signal. Thus, we do not find substantial evidence that the
20 embodiment depicted in figure 5(a) teaches splitting the power from one
21 source to counter pump one fiber segment and co-pump another segment or
22 that the distributor (item 24) unequally splits the beam.

24 Fludger teaches that systems which use Raman fiber amplifiers may be

1 be co-pumped or counter-pumped (Fludger, introduction on p. 15). Fludger
2 discusses the effects of each on relative intensity noise (RIN). Fludger
3 concludes that in counter-pumped Raman amplification the different
4 directions of propagation cause the noise to be low pass filtered (Fludger,
5 conclusion on p. 17). We find no discussion in Fludger of splitting the beam
6 of light from one pumping source into two unequal portions and counter-
7 pumping one segment with one portion of the beam and co-pumping another
8 fiber with the other portion of the beam.

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10 ANALYSIS

11 Independent claim 1 recites “a first pump . . . to generate and transmit
12 a first light beam, a first splitter configured to receive the first light beam,
13 split the first light beam into a first portion of the first light beam and a
14 second portion of the first light beam, transfer the first portion of the first
15 light beam onto the first fiber span to backward propagate over the first fiber
16 span, and transfer the second portion of the first light beam onto the second
17 fiber span to forward propagate over the second fiber span.” Claim 1 also
18 recites a second pump and splitter which transfers light to backward
19 propagate the second fiber and forward propagate a third fiber. We find no
20 limitations that recite that the first, second or third fiber is simultaneously
21 forward and reverse propagated. We are not persuaded by Appellant’s
22 argument that the recitations of beam transmission by pumps of claim 1 must
23 be interpreted as simultaneous pumping, as the specification does not
24 contemplate one pump source to operate while the other is off. Claim 1

1 recites a system “comprising” various elements; this does not limit the claim
2 to a system containing only the recited elements, rather it is open ended and
3 encompasses any system that includes the recited elements. Further, before
4 the Office, claims are to be given their broadest reasonable interpretation. We
5 consider the Examiner’s interpretation to be reasonable and Appellant’s
6 asserted reading of simultaneous forward and backward pumping of a fiber
7 span to be importing limitations from the specification into the claims.
8 Through a similar analysis we do not find that claim 11 recites simultaneous
9 forward and backward pumping of a fiber span.

10 Claim 1 also recites “wherein a power of the first portion of the first
11 light beam is not equal to a power of the second portion of the first light
12 beam; and wherein a power of the first portion of the second light beam is
13 not equal to a power of the second portion of the second light beam.” Thus,
14 claim 1 recites that the beam from the first pump is split into two unequal
15 parts and that the beam from the second pump is split into two unequal parts.
16 Accordingly, we disagree with the Examiner’s claim interpretation and find
17 that claim 1 recites an uneven split of a single light beam.

18 Having determined the scope of the claims, we next consider the art
19 applied to reject the claims. Independent claims 1 and 11 stand rejected over
20 Grubb in view of Fludger. The Examiner’s rejection relies upon the system
21 arrangement depicted in figure 5(a) of Grubb. As discussed *supra*, we find
22 that Grubb provides scant description of how the fiber segments 28, 30 or 40
23 are being pumped. Thus, we find that Grubb alone fails to provide
24 substantial evidence of using one laser through a splitter to forward pump

1 one fiber segment and reverse one fiber segment. As discussed *supra*, Grubb
2 is silent as to the operation of splitter 24 and as such fails to provide
3 substantial evidence of splitting a single beam in to two un-equal parts.
4 Further, we find no discussion in Fludger of splitting a beam into two
5 unequal parts. Thus, we do not find that the combination of Grubb and
6 Fludger teach all of the limitations of independent claims 1 and 11.

7 We further note that the art used to reject the other dependent claims,
8 Fidric and Agrawal, does not teach splitting a beam into two unequal parts
9 and using the parts to forward pump one fiber segment and reverse pump a
10 second fiber segment.

CONCLUSION

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13 We consider the Examiner's rejection of claims 1, 4 through 11, and
14 14 through 20 under 35 U.S.C. § 103(a) to be in error as we do not find that
15 the combination of the combination of Grubb in view of Fludger teaches or
16 suggests the limitations in independent claims 1 and 11. The Examiner has
17 not asserted, nor do we find that Fidric or Agrawal, the references applied
18 against claims 5, 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, and 20, make up for the
19 noted deficiencies in the rejection of independent claims 1 and 11.
20 Accordingly we will not sustain the Examiner's rejection of claims 35 U.S.C.
21 § 103 (a) of claims 1, 4 through 11 and 14 through 20.

1 ORDER

2 For the forgoing reasons, we will not sustain the Examiner's
3 rejections, under 35 U.S.C. § 103. The decision of the Examiner is reversed.

5 REVERSED

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JRG

Appeal 2007-0680
Application 10/655,901

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